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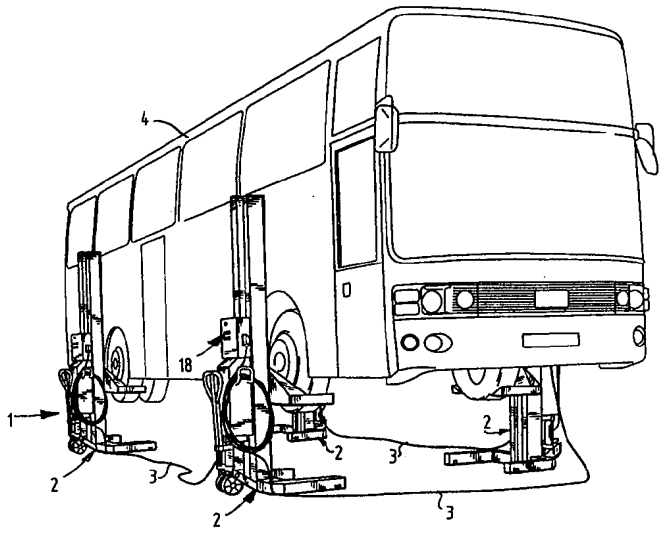

(57) Abstract

The invention relates to a lifting device (1) comprising at least two separately displaceable lifting columns (2) which each comprise a column (2) provided with a support foot (8), a carriage (7) guided slidably in longitudinal direction of this column (2), a lifting member (9) arranged on a foot end of the carriage (7), drive means (10) for displacing the carriage (7) in longitudinal direction relative to the column (2) and control means (14) for the drive means (10). The lifting device (1) is provided with connecting lines (3) for connecting the control means (14) of the columns (2) and operating means (18) connected to the connecting lines (3) for at least simultaneous operation of the control means (14) of all lifting columns (2). The connecting lines (3) form part of a digital data bus and the operating (18) and control means (14) are adapted such that they exchange digital control signals via this data bus.

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LIFTING DEVICE WITH MOVABLE LIFTING COLUMNS

The invention relates to a lifting device which comprises at least two separately displaceable lifting columns, as described in the preamble of claim 1.

Such a lifting device is known and is used particularly for lifting heavy vehicles, such as trucks and buses.

The signals required to cause all lifting columns to operate as a unit are transmitted with the connecting lines. These signals comprise activating signals for switching on and off the drive means of each lifting column and also monitoring signals for comparing the lifting height of each lifting column. The lifting columns are thus mutually coupled by the connecting lines to form one lifting device which functions in substantially the same manner as a customary vehicle lift.

The invention has for its object to further develop the known lifting device in order to give it more application options.

This object is achieved in the lifting device according to the invention with the steps characterized in claim 1. The lifting columns are hereby no longer considered as composite parts of a whole device but as separate devices which co-act in random numbers. With the invention is achieved that a wide diversity of control and monitoring signals can be exchanged between the separate lifting columns mutually and with the operating means, whereby the options for use of the lifting device according to the invention are greatly increased.

A favourable further development is characterized in claim 2. Also communicating the safety signals via the data bus ensures that a random number of

co-acting lifting columns can co-act reliably and, in particular, with great safety.

The measure of claim 3 is preferably applied. The CAN data bus and components therefor are well standardized, so that the control and operating means can be constructed and embodied in reliable manner. Because this data bus only requires two wires, the connecting lines remain well manageable and little vulnerable.

Applying the measure of claim 4 achieves that the proper operation of all lifting columns can be ascertained from the operating means. Control signals for setting the safety means into operation can be transmitted in one direction in the closed circuit, which results in a high reliability.

According to a further development the measure of claim 5 is applied. The user can select the lifting column which is most suitable for him for the operation of the whole device.

With the measure of claim 6 the energy supply for each, or at least a number of the lifting columns can take place via the at least one lifting column. It is possible for instance to dimension the supply voltage lines such that a total of four lifting columns are supplied via the one lifting column. The at least one lifting column can herein be provided with overload protection means which ensure switching off of the power supply in the case of overload of several or all coupled lifting columns.

In a suitable embodiment the measure of claim 7 is applied. The relative position of each lifting column is hereby easily identifiable by the operating means.

A very suitable further application is characterized in claim 8. As pairs are for instance designated the lifting columns which are disposed on either side of the same vehicle axle. It hereby becomes possible, when a vehicle is supported by more than four lifting columns, for instance to build in or remove an

axle by independently operating the two lifting columns forming part of one pair.

With the measure of claim 9 the separate operation of the lifting columns mutually associated to form a pair can be performed in simple manner from the operating means.

After adjustment of one of the pairs, the other co-acting pairs can be identified simply by the operating means by applying the measure of claim 12.

The invention is further elucidated in the following description with reference to the annexed figures.

Figure 1 shows a lifting device of the present type in the position of use.

Figure 2 shows a lifting column of the lifting device of figure 1.

Figure 3 shows schematically six lifting columns mutually coupled by connecting lines.

The lifting device 1 according to the invention shown in figure 1 comprises four separately displaceable lifting columns 2 which co-act to lift a bus 4. For the co-action the lifting columns 2 are mutually coupled by means of connecting lines 3 which form part of a digital data bus of the CAN type.

As shown in figure 2, each lifting column 2 comprises a column 6 in which a carriage 7 is guided slidably in longitudinal direction. On the bottom end of column 6 is arranged a support foot 8 with which the column can be deployed stably on a ground surface.

Carriage 7 bears on its lower end a lifting member 9 which is provided with two protrusions 16 which can engage around a vehicle wheel. Carriage 7 can be displaced in column 6 by means of drive means in the form of a hydraulic cylinder 10. This hydraulic cylinder 10 is fed with hydraulic oil under pressure from a hydraulic unit 11, which is per se known and not shown in detail.

Such a hydraulic unit 11 comprises a hydraulic pump driven by an electric motor, which can draw hydraulic oil out of a reservoir and press it under pressure into cylinder 10 in order to move the carriage 7 upward.

Control of hydraulic unit 11 takes place with per se known control means which are accommodated in a box 14 on lifting column 2.

In order to enable displacement of lifting column 2 and positioning with protrusions 16 on either side of a vehicle wheel, the lifting column 2 is provided with wheels 12. These wheels 12 form together with push-bar 13 a mechanism which is per se known for pallet trucks. By moving push-bar 13 up and downward in pumping manner the wheels 12 can be moved downward relative to support foot 8 whereby lifting column 2 becomes displaceable on wheels 12. By operating a hydraulic valve the wheels 12 are retracted, whereby support foot 8 comes to lie on the ground.

In the mobile situation the lifting column 2 can be manoeuvred using push-bar 13.

Control means 14 comprise per se known switching means for switching on and off hydraulic unit 11. This switch-on/off command is given by activating the operating means 18. Control means 14 for each lifting column 2 and the operating means 18 are embodied such that they can exchange signals via the connecting lines 3.

As shown in figure 1, each of the lifting columns is provided with a length of line 3 which carries on its end a connector which is connected to a connector terminal 15 of an adjacent lifting column 2. Control means 14 and operating means 18 are thus connected in a series as shown in figure 3 for a lifting device comprising six lifting columns.

In the shown embodiment two conductors in connecting lines 3 form parts in each case of a digital CAN data bus. Connecting lines 3 can further comprise conductors for the supply current of the hydraulic units.

Because the control means and operating means are mutually coupled by means of the CAN data bus, a variety of signals can be sent to and from each lifting column. For a good co-action with the CAN data bus the control means are based on a microprocessor, so that the different options can be entered by programming.

A suitable possibility, which can be applied particularly when more than four lifting columns are used, is to cause determined lifting columns to be raised and lowered independently. The two lifting columns deployed on either side of an axle of a vehicle can for instance be jointly moved upward and downward, while others retain the adjusted height, for the purpose of changing a vehicle axle.

For this purpose a serial number is assigned to each of the lifting columns for addressing the control signals. In figure 3 these serial numbers are designated schematically with I-VI. Assigning of these serial numbers can take place simply after arranging connecting lines 3. Operating means 18 can perform a program-controlled query over the data bus in order to establish how many lifting columns are connected to the data bus and subsequently assign the serial number to each of these lifting columns. The software can be embodied such that the lifting columns associated in each case with one axle are then mutually associated to form independently operable pairs. In the diagram of figure 3 the lifting columns designated II and V can for instance be operated in suitable manner as a separate pair in order to move an axle supported by these lifting columns separately upward and downward.

Figure 3 shows that each column bears operating means 18, so that the whole lifting device can be operated at each column. It is also possible to embody the operating means 18 as a separate unit which can exchange signals with control means 14 via a cable connection. The cable connection can for instance be made as required with a random column.

As shown in figure 3, the connecting lines 3 are connected in a closed circuit, wherein one lifting column in each case is connected to a subsequent one. Control and safety signals can hereby be fed back via the closed circuit to the operational operating means 18, whereby monitoring of the proper operation of all connected columns becomes possible and the data flow can for instance take place in one direction, which results in a simple and therefore reliable embodiment.

Mutually associating determined lifting columns to form an independently operable pair can also take place in a less well developed embodiment of the invention in that an operator enters data concerning the co-acting columns into the control means. Each lifting column can thus be provided with an independently actuable adjusting member which, after actuation, places the device in a learning mode. If within a determined time after actuation of the adjusting member on one column a corresponding adjusting member on another column is actuated, the control device will mutually associate these two columns to form an independently operable pair.

The invention is not limited to the embodiments shown in the figures and described above. Through use of the digital data bus in combination with suitable programming of the control and operating means a lifting device can be given the functionality desired for a particular application.

CLAIMS

1. Lifting device comprising at least two separately displaceable lifting columns which each comprise a column provided with a support foot, a carriage guided slidably in longitudinal direction of this column, a lifting member arranged on a foot end of the carriage, drive means for displacing the carriage in longitudinal direction relative to the column and control means for the drive means, wherein the lifting device is provided with connecting lines for connecting the control means of the columns and operating means connected to the connecting lines for at least simultaneous actuation of the control means of all lifting columns, **characterized in that** the connecting lines form part of a digital data bus and the operating and control means are adapted such that they exchange digital control signals via this data bus.

2. Lifting device as claimed in claim 1, wherein each lifting column comprises safety means for switching off the drive means on activation thereof, wherein the safety means likewise exchange digital control signals via the data bus.

3. Lifting device as claimed in claim 1 or 2, wherein the digital data bus is of the two-wire CAN type.

4. Lifting device as claimed in any of the foregoing claims, wherein all lifting columns are connected by the connecting lines in a closed circuit.

5. Lifting device as claimed in any of the foregoing claims, wherein each lifting column comprises operating means and switching means are provided for switching on specific control means of a lifting column as operating means for the whole lifting device.

6. Lifting device as claimed in any of the foregoing claims, wherein at least one lifting column is provided with an electrical power supply connection and a number of other lifting columns are not, and the connecting lines comprise electrical supply lines.

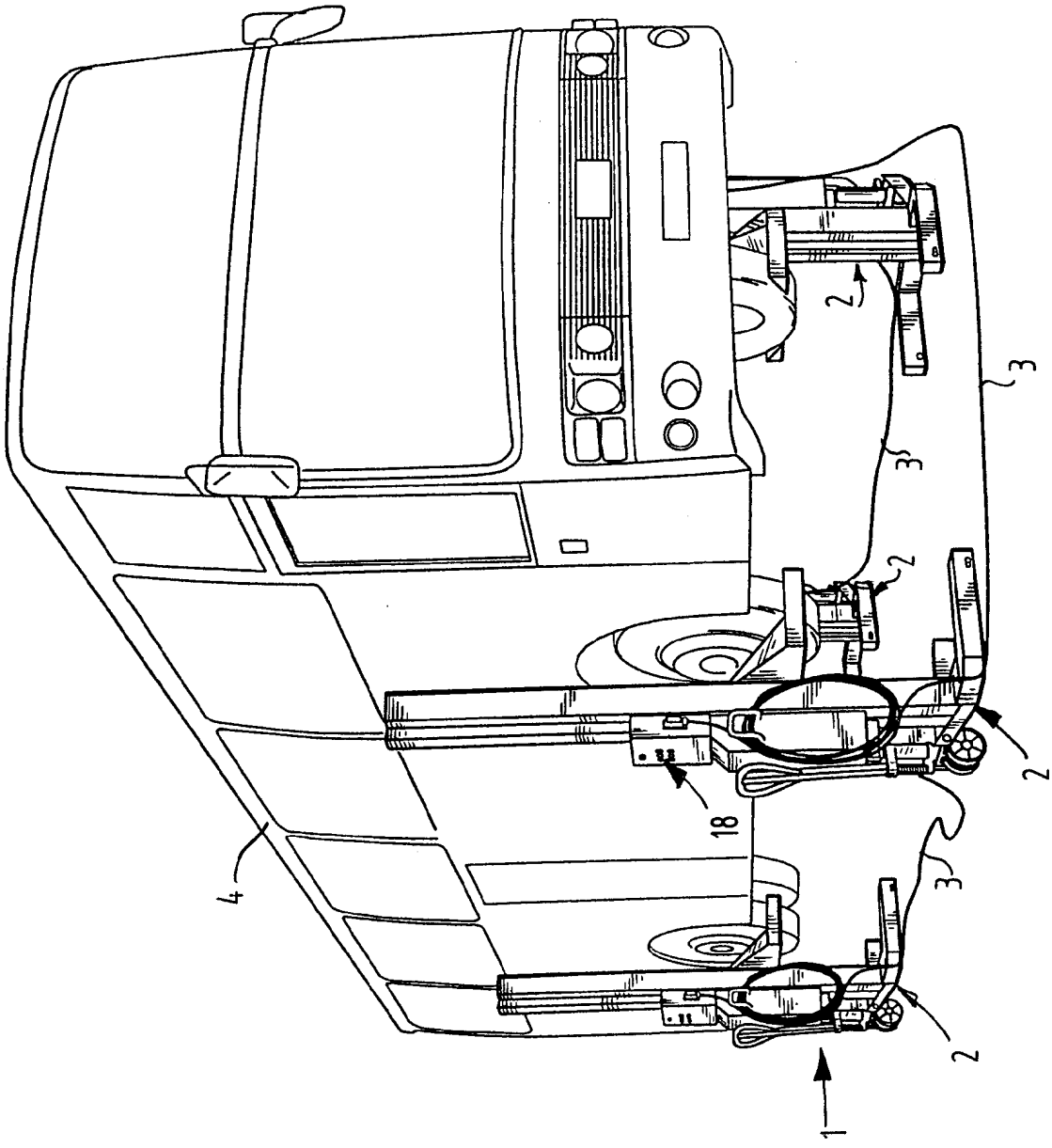
7. Lifting device as claimed in any of the foregoing claims, wherein the operating and control means are adapted such that, after arranging of the connecting means, they assign to each of the lifting columns a serial number intended for addressing of the control signals.

8. Lifting device as claimed in any of the foregoing claims, wherein the operating and control means comprise adjusting members for mutually associating determined lifting columns to form independently operable pairs.

9. Lifting device as claimed in claims 7 and 8, wherein the adjusting members mutually associate determined lifting columns by recording in the control means the respective serial numbers of the mutually associated lifting columns.

10. Lifting device as claimed in claim 9, wherein lifting columns of each of the mutually associated lifting columns standing adjacently in a determined direction are mutually associated to form an independently operable pair.

FIG.1



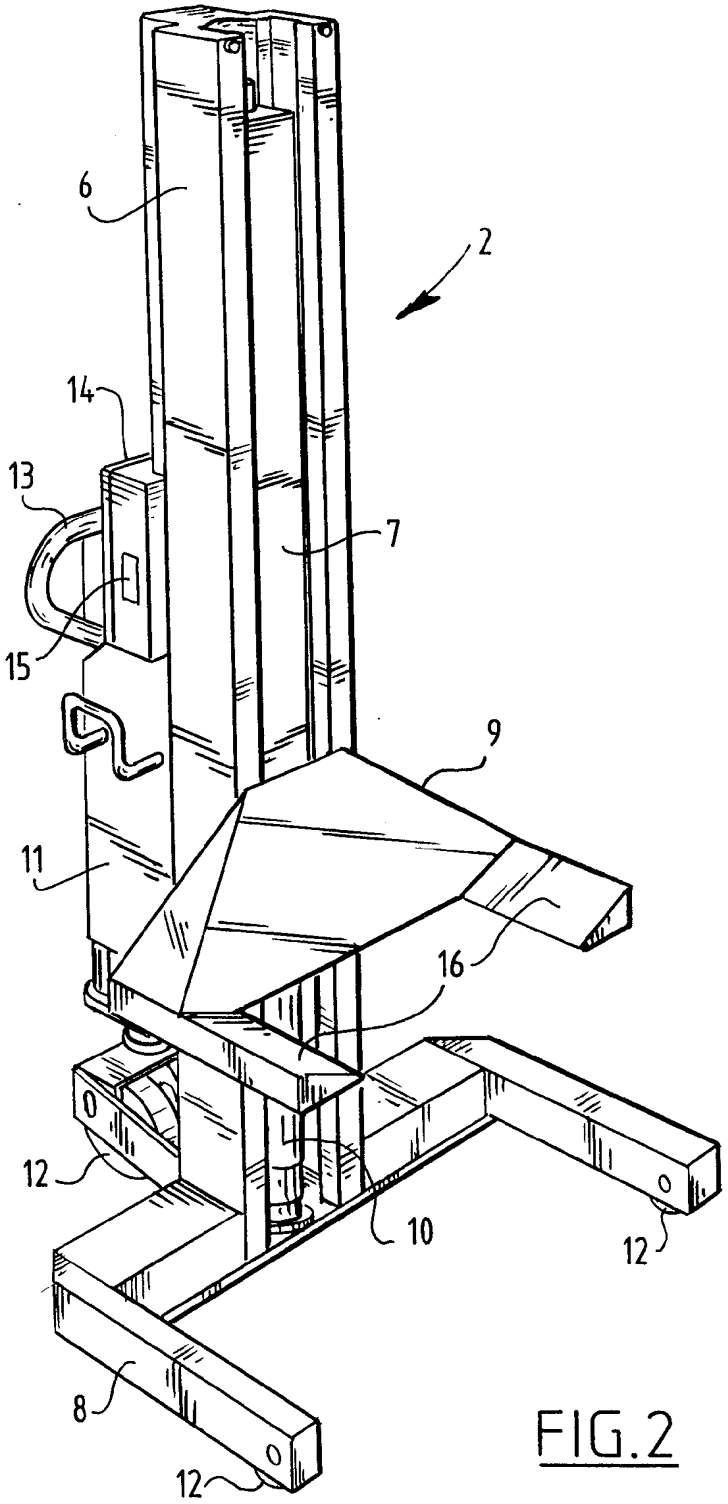


FIG.2

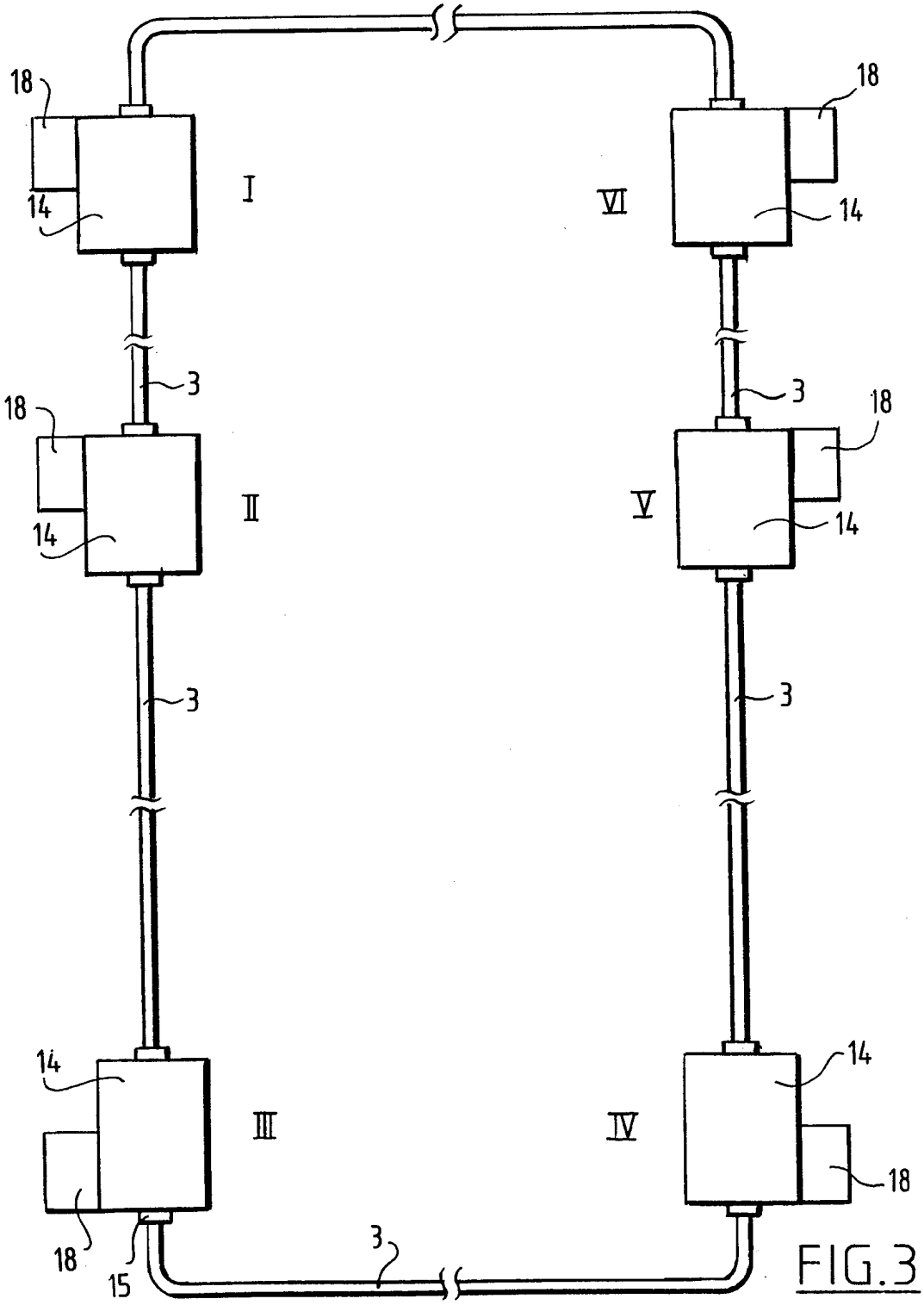


FIG.3

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/NL 98/00014

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B66F3/46

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B66F

Documentation searched other than minimumdocumentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 747 535 A (BILFINGER BERGER BAU) 11 December 1996 see claim 1	1
A	AT 325 811 A (DICKERTMANN HEBEZEUGFAB AG) 10 November 1975 see page 3, line 1-10; figure 2	1
A	DE 36 18 072 A (GERB ELEKTRONIK GMBH) 3 December 1987 see column 3, line 1-4 - column 3, line 47-56	1
A	US 4 484 264 A (FRIEDLI PAUL ET AL) 20 November 1984 see column 3, line 12-32	1

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[X] Further documents are listed in the continuation of box C.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

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